Int. j. adv. multidisc. res. stud. 2025; 5(2):1560-1567

Received: 17-02-2025
Accepted: 27-03-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Risk-Factors and Management of Type 1 Diabetes Mellitus: Determining the Level of Association Between Socio-Demographic Variables and Risk Factors of Type 1 Diabetes Mellistus Among Children and Adolescents in Owerri Municipal and West Lga, Imo State

[1] Okoro Chisomuaga Chidinma, [2] Joakin Chidozie Nwaokoro, [3] Ugonma Winnie Dozie, [4] Odinaka Kizito C

[1, 2, 3, 4] Department of Public Health, Federal University of Technology, Owerri, Nigeria

DOI: https://doi.org/10.62225/2583049X.2025.5.2.4023
Corresponding Author: **Odinaka Kizito C**

Abstract

The exact underlying trigger of T1DM is a complicated interaction of genetic and environmental factors that is still not fully understood. This study identified the risk factors and management measures of Type 1 diabetes mellitus (T1DM) among children and adolescents in facilities in Owerri Metropolis. Using a cross-sectional study design, seventy (70) were conveniently recruited from Stella Maris Hospital Owerri, Imo State. A Semi-Structured questionnaire was the tool used in gathering the information needed for the study. Data were subjected to descriptive statistics and Chi-square using SPSS statistics version 23. The respondents were insignificantly dominated by female 36(51%) and were within the age bracket of 9-17 years 45(64%). Most of them were in secondary school 43(61%) with their caregivers achieving Tertiary education as highest qualification 45(64%). Majority was diagnosed with type 1 diabetes at the age bracket of 10-14 years 33(47%). A greater proportion 56(80%) of the respondents had normal body mass index (BMI) and had siblings 40(57%) and grandparents 44(70%) that suffered Type 1 diabetes 40(57%) and Type 2 Diabetes 63(90%) respectively. Equally, socio demographic attributes, especially child's age bracket and age at diagnosis of the child/adolescent demonstrated significant association ($p \leq 0.05$) with some T1DM risk factors. Therefore, interventions that aim to minimize exposure to those risk factors are recommended in genetically susceptible patients.

Keywords: T1DM, Adolescents, Nigeria

Introduction

In Nigeria, the calculated prevalence rate of T1DM is 4.44%. [11]. However, few data exist on the population prevalence of diabetes mellitus amongst children and young adults in Nigeria [15], as well as its risk factors. Moreover, these estimates might not reflect the real problem on ground due to limited data available in regions of the country. Furthermore, in industrialized nations, enormous efforts have been made to manage type 1 diabetes and reduce chronic complications of the disease, while in many developing countries, there is limited clinical and metabolic data on the disease in children making its management even more difficult [13]. Additionally, pediatric diabetes management has remained a major challenge to the patient, the healthcare provider as well as family members of the patients [2, 4, 12]. More so, some of the major challenges to type 1 diabetes management in sub- Saharan Africa include; missed and delayed diagnosis as well as insulin unavailability [9]. However, despite advances in insulin therapeutics, adherence to diabetes regimens is often very difficult for patients of all ages especially adolescents [16, 10]. According to [11], 1.52 million of the 8.75 million people living with type 1 diabetes around the world in 2022 were less than 20 years old. This is particularly concerning since people diagnosed with T1DM at age < 20 years have up to five-fold excess mortality risk [8], and most symptoms are not severe, which may cause damage or even failure of different organs in the long run and lead to irreparable injuries such as blindness, amputation, stroke and eventually death [14]. Furthermore, a combination of genetic and environmental factors mediates the development of type 1 diabetes. Genetic predispositions increase the risk of developing the type 1 diabetes that is triggered by environmental factors [6]. Environmental

factors could provide possible explanations for the current global increase in the incidence rates of type 1 diabetes and might include dietary factors such as vitamin D deficiency; early infancy diets with a lack of breastfeeding; and early exposure of infants to cow's milk and to wheat proteins (especially gluten) respectively [5, 17, 3]. Other environmental factors can include viruses and bacteria. Exposure to certain viruses such as Enterovirus, Rota, Rubella, Mumps, and Cytomegalovirus, or disruption of gut microbiota may predispose children to type 1 diabetes. The hygiene hypothesis suggests that exposure to a variety of infections during infancy and early childhood may protect children from developing type 1 diabetes later in their lives [17, 7, 3]. Perinatal and psychological stresses such as pre-eclampsia; higher maternal age; higher body mass index; and stress may also be associated with the development of type 1 diabetes [3]. It has been suggested that the current increase of type 1 diabetes incidence is a multi-factorial process that cannot be explained by one single factor, rather it is an interaction between genetics and environmental factors [1, 3]. Considering the risk factors associated with type 1 diabetes mellitus among children and adolescents, this study which is an excerpt from a component of a larger study, investigated the level of association between socio-demographic variables and risk factors of T1DM among children and adolescents in facilities in Owerri municipal and west LGA, Imo state.

Methods

Study setting

The study location is Stella Maris Hospital World Bank Estate Owerri, Imo state Nigeria. Owerri lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E, occupying an area of about 5,100 square kilometers Owerri is also the state's largest city, followed by Orlu and Okigwe. Owerri Metropolis consists of three local government area namely; Owerri municipal, Owerri north, and Owerri west with a combined population estimate of 983,352 (NPC, 2023). The hospital is a private hospital, located at Owerri Municipal, Owerri Municipal Local Government, Imo State. It was established on 10/20/2000, and Licensed by the Nigeria Ministry of Health, with facility code 16/25/1/2/2/0008 and registered as Secondary Health Care Centre. The hospital operates on 24 hours basis, it has 150 bed capacity and offer clinical services like general outpatient services, gastroenterology, pulmonology, Pediatrics, General Surgery, Antenatal Care (ANC), HIV/ AIDS Services, Non Communicable Diseases, Family Planning, Hepatitis, Nutrition, Obstetrics. Besides, Stella Maris Hospital was selected due to its recognized standard pediatric section, which will increase the likelihood of encountering children with T1DM.

Study design and sampling

A Hospital based cross-sectional study design was employed for the study and included patients aged 5-8 and 9-17years respectively who are receiving treatment at the pediatric and outpatient clinic of the elected hospital StellaMaris Hospital) and also a control group of non-diabetic patients aged 5-8 and 9-14 years respectively who are receiving treatment at the pediatric and outpatient clinic of the selected hospital. The population was based on the availability of patients and the time span of the study. A sample size of 78 was estimated using the Leslie Kish formula. Although, a total of 70 were correctly filled and as such were employed for the analysis.Convenience sampling method was employed to select participants for the study. Every child and adolescent (participants) who registered to see the clinicians on each consulting day during the study period and who met the inclusion criteria were consecutively recruited. Every week an average 5 participants were selected based on the inclusion and exclusion criteria. This selection method continued until the desired sample size of 60 was achieved, facilitating the inclusion of a diverse range of T1DM patients from these selected hospitals.

Data collection

A semi-structured questionnaire developed based on reviewed literature was employed for the study, patients anthropometry were measured using a weighing scale and a tape rule. The questionnaire was pre tested using a multi-phase sampling technique by administering it to 15 type 1 diabetic patients from another health facility which was not part of the selected study population but shared similar characteristics with the selected study population and after two weeks, the same but fresh copies of questionnaire were re-administered to the same set of respondents. The questionnaire was validated using face and contents validation by an endocrinologist. The questionnaire was tested for reliability using Crombach Alpha test and a reliability coefficient of 0.81 was obtained. Data was collected within the period of January till March 2024 and potential respondents were approached and were given the questionnaire and asked to fill and return it at the end of the clinicsession.Also, weight and height were measured using standard procedures. Weight was measured in kilograms using a pre-calibrated weighing scale to the nearest 0.5 kg on a flat surface with the subject wearing light clothing. Height was measured to the nearest 0.5cm in meters with a tape ruler with subject not wearing shoes.

Data Analysis

The data obtained in this study were analyzed using IBM-SPSS version 21 and EXCEL 2019 software. A descriptive method was employed to summarize the data characteristics. Frequency distribution tables were constructed for all variables and were expressed as the percentage of the distribution. BMI was calculated and interpreted in respect to the BMI-for-age weight percentiles. The Chi-square test was used to examine association, comparisons, and proportions of different potential risk factors, for each variable, the p value was assessed with $p \leq 0.05$ being statistically significant.

Results

Socio demographic characteristics

Socio-demographic characteristics of the respondents are summarized in Table 1 where all the variables differed significantly ($p \leq 0.017$) except for gender. It was shown that out of the 70 respondents used for the study, age bracket of majority of them was 9-17 years 45 (64%) followed by those within 5-8 years 25 (36%). Most of the participants were female 36 (51%) compared to their male counterpart 34 (49%). Numerous of them were patients in Federal University Teaching Hospital Owerri 48 (69%) followed by those attending Imo State Specialist Hospital 22 (31%). On

religion, the Table showed that almost all the participants were Christians 64 (91%) whereas 6(9%) of them were Muslims and none was a Traditionist. Besides, out of the 70 participants, a greater proportion of them were from Igbo tribe 58(83%) followed by Yoruba 8(11%) and Hausa 4(6%) and none was from Fulani. Child's educational level was represented as four categories: nursery with 9 participants or 13%, primary with 18 or 26%, Secondary with 43 or 64% and none of them was not yet in school. Equally, caregiver's educational level was represented as four categories: Primary with 10 participants or 14%, secondary with 15 or 21%, tertiary with 45 or 64% and none of them was not attending any education. Age(years) at diagnosis of the child/adolescent variable for the participants ranged from < 2, 2-5, 6-9, 10-14 and 15-19 years. Age of participants categorized from < 2 was 5 (7%), 2-5 was 10 (14%), 6-8 was 17 (24%), 9-15 was 33 (47%) and 15-19 was 5 (7%).

Table 1: Socio demographic characteristics

Variables	Frequency	Percentage
Child's age bracket		
5-8 years	25	36
9-17 years	45	64
Total	**70**	**100**
Gender		
Male	34	49
Female	36	51
Total	**70**	**100**
Religion		
Christianity	64	91
Muslim	6	9
Traditional	0	0
Total	**70**	**100**
Ethnicity		
Igbo	58	83
Hausa	4	6
Yoruba	8	11
Fulani	0	0
Total	**70**	**100**
Child's educational level		
Nursery	9	13
Primary	18	26
Secondary	43	61
Not yet in school	0	0
Total	**70**	**100**
Caregiver's educational level		
Primary	10	14
Secondary	15	21
Tertiary	45	64
None	0	0
Age (years) at diagnosis of the child/adolescent		
Total	**70**	**100**
< 2	5	7
2-5	10	14
6-8	17	24
9-15	33	47
15-19	5	7
Total	**70**	**100**

Distribution of family history risk factors in association with socio demographic characteristics

Table. 2a, and b summarized the results of the association of family history risk factors with socio demographic characteristics of the participants where few of the parameters exhibited significant association. It was shown that majority of the participants that had family history of type 1 (TD1) 27(39%) and type 2 diabetes (TD2) 43(61%) were mostly those within the age range of 9-17years. Family members with type 1 Diabetes 13(33%) and type 2 Diabetes 34(54%) were mostly Siblings and grandparents respectively significant association (X^2= 5.58; p = 0.134).In addition, it was shown in Table 3b that all the socio demographic characteristics exhibited significant association with history of diabetes risk factors apart from family history of type 2 diabetes (X^2= 5.11; p = 0.276). A larger proportion of participants with family history of Type 1 diabetes 25(36%) and Type 2 diabetes 32(46%) were diagnosed at the age range of 10-14 yrs. Accordingly, majority of them within 5-8 years and 9-17 years had siblings 15(21%) and grandparents 22(31%) as family member with type 1 and type 2 diabetes respectively.

Table 2a: Distribution of family history risk factors in association with child's age bracket and gender

	Child's age bracket					Gender				
Variables	**5-8 years**	**9-17years**	**Total**	X^2	**p-value**	**male**	**female**	**Total**	X^2	**p-value**
Had family history of Type 1 Diabetes										
Yes	13(19%)	27(39%)	40(57%)			21(30%)	19(27%)	40(57%)		
No	12(17%)	18(26%)	30(43%)			13(19%)	17(24%)	30(43%)		
Total	25(36%)	45(64%)	70(100%)	**0.42**	**p = 0.517**	34(49%)	36(51%)	70(100%)	**0.58**	**p = 0.448**
Had family history of Type 2 Diabetes										
Yes	20(29%)	43(61%)	63(90%)			31(44%)	32(46%)	63(90%)		
No	5(7%)	2(3%)	7(10%)			3(4%)	4(6%)	7(10%)		
Total	25(36%)	45(64%)	70(100%)	**4.32**	**p = 0.038**	34(49%)	36(51%)	70(100%)	**0.1**	**p = 0.750**
Family member with Type 1 diabetes										
Father	3(8%)	1(3%)	4(10%)			2(5%)	2(5%)	4(10%)		
Mother	9(23%)	2(5%)	11(28%)			7(18%)	4(10%)	11(28%)		
Siblings	13(33%)	12(30%)	25(63%)			15(38%)	10(25%)	25(63%)		
Total	25(63%)	15(38%)	40(100%)	**3.19**	**p = 0.202**	24(60%)	16(40%)	40(100%)	**0.23**	**p = 0.893**
Family member with Type 2 diabetes										
Father	6(10%)	6(10%)	12(19%)			4(6%)	8(13%)	12(19%)		
Mother	4(6%)	3(5%)	7(11%)			4(6%)	3(5%)	7(11%)		
Siblings	0(0%)	0(0%)	0(0%)			0(0%)	0(0%)	0(0%)		
Grandparents	10(16%)	34(54%)	44(70%)			21(33%)	23(37%)	44(70%)		
Total	20(32%)	43(68%)	63(100%)	**5.58**	**p = 0.134**	29(46%)	34(54%)	63(100%)	**1.18**	**p = 0.758**

Table 2b: Distribution of family history of diabetes risk factors in association with age at diagnosis of the child/adolescent

	Age at diagnosis of the child/adolescent							
Variables	**< 2 yrs**	**2-5 yrs**	**6-8 yrs**	**9-15 yrs**	**15-19 yrs**	**Total**	X^2	**p-value**
Had family history of Type 1 Diabetes								
Yes	3(4%)	4(6%)	7(10%)	25(36%)	1(1%)	**40(57%)**		
No	2(3%)	6(9%)	10(14%)	8(11%)	4(6%)	**30(43%)**		
Total	5(7%)	10(14%)	17(24%)	33(47%)	5(7%)	**70(100%)**	**10.47**	**p = 0.033**
Had family history of Type 2 Diabetes								
Yes	4(6%)	8(11%)	14(20%)	32(46%)	5(7%)	**63(90%)**		
No	1(1%)	2(3%)	3(4%)	1(1%)	0(0%)	**7(10%)**		
Total	5(7%)	10(14%)	17(24%)	33(47%)	5(7%)	**70(100%)**	**5.11**	**p = 0.276**
Family member with Type 1 diabetes								
Father	0(0%)	1(1%)	1(1%)	2(3%)	0(0%)	**4(6%)**		
Mother	2(3%)	3(4%)	1(1%)	1(1%)	4(6%)	**11(16%)**		
Siblings	3(4%)	6(9%)	15(21%)	0(0%)	1(1%)	**25(36%)**		
Total	5(7%)	10(14%)	17(24%)	3(4%)	5(7%)	**40(57%)**	**24.3**	**p = 0.002**
Family member with Type 2 diabetes								
Father	2(3%)	1(1%)	3(4%)	2(3%)	4(6%)	**12(17%)**		
Mother	1(1%)	2(3%)	2(3%)	1(1%)	1(1%)	**7(10%)**		
Siblings	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	**0(0%)**		
Grandparents	1(1%)	6(9%)	11(16%)	22(31%)	0(0%)	**40(57%)**		
Total	4(6%)	9(13%)	16(23%)	25(36%)	5(7%)	**59(84%)**	**21.71**	**p = 0.041**

Distribution of maternal risk factors in association with socio demographic attributes

Presented in Table 3a-d are the results of the association between maternal risk factors and socio demographic characteristics where few of the parameters exhibited significant association where it was shown that both child's age bracket and gender demonstrated significant association with gestational diabetes during pregnancy and mode of delivery. In addition, it was shown that child's age bracket had significant association with preeclampsia during pregnancy and use of antibiotics during pregnancy. Type 1 diabetes was found most among participants within 9-17 years, whose mothers always 28(40%) consumed tea and never 36(51%) consumed coffee during pregnancy. Amongst these age group, greater proportions of their mothers 40(57%) did not experienced preeclampsia and infectious disease 42(60%) during pregnancy. However, most of the mothers of the participants within 9-17years sometimes 33(47%) made use of analgesics. Besides, most of the mothers of the participants within 9-17 years never made use of antibiotics 41(59%) and antihypertensive drugs 40(57%) during pregnancy. Moreover, a greater part of them 40(57%) had not made use of insulin during pregnancy. Also, in Table 3a was also shown that higher number of these age category had mothers who experienced gestational diabetes during pregnancy 36(51%) and gave birth through C-Section 41(59%) with significant association (X^2= 29.7; p < 0.001).

As regards the association that gender had with maternal risk factors, it was shown that most of the respondents belonging to the male category had mothers who always 23(33%) consumed tea and never 27(39%) consumed coffee during pregnancy. Greater proportions of the mothers of the female participants 30(43%) did not experienced preeclampsia and infectious disease 35(50%) during pregnancy. However, most of their mothers of sometimes 28(40%) made use of analgesics. Besides, most of the mothers of the male and female participants never made use

of antibiotics 29(41%) and antihypertensive drugs 31(44%) during pregnancy respectively. Moreover, a greater part of the male and female did not make use of insulin 32(46%) but had gestational diabetes 32(46%) during pregnancy respectively. Furthermore, it was shown that among the participants, higher number of the male gender had mothers who gave birth through C-Section 29(41%) with significant association (X^2= 4.94; p = 0.026).

As regards the association that the age at diagnosis of the child/adolescent had with maternal risk factors, it was shown that only preeclampsia during pregnancy displayed significant association (X^2= 9.6; p = 0.048) with age at diagnosis of the child/adolescent. A larger proportion of the subjects were diagnosed at 10-14 years and were those whose mother always 22(31%) consumed tea and never 28(40%) consumed coffee during pregnancy. Within these age group, greater proportions of their mothers 29(41%) did not experienced preeclampsia and infectious disease 31(44%) during pregnancy. However, most of the mothers of these participants diagnosed at 10-19 years sometimes 25(36%) made use of analgesics. Moreover, most of the mothers of the participants never made use of antibiotics 30(43%) and antihypertensive drugs 31(44%) during pregnancy. Moreover, a greater part of them 30(43%) had not made use of insulin during pregnancy. it was also observed that higher number of these age category had mothers who experienced gestational diabetes during pregnancy 28(40%) and gave birth through C-Section 20(29%) with significant association (X^2= 4.29; p = 0.368).

Table 3a: Distribution of maternal risk factors in association with child's age bracket and gender

	Child's age bracket					Gender				
Variables	**5-8 years**	**9-17years**	**Total**	X^2	**p-value**	**Male**	**Female**	**Total**	X^2	**p-value**
Tea consumption during pregnancy										
Always	15(21%)	28(40%)	43(61%)			23(33%)	20(29%)	43(61%)		
Sometimes	7(10%)	15(21%)	22(31%)			9(13%)	13(19%)	22(31%)		
Never	3(4%)	2(3%)	5(7%)			2(3%)	3(4%)	5(7%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**1.44**	**p = 0.486**	**34(49%)**	**36(51%)**	**70(100%)**	**1.08**	**p = 0.583**
Coffee consumption during pregnancy										
Always	2(%)	1(%)	3(%)			1(1%)	2(3%)	3(4%)		
Sometimes	7(10%)	8(11%)	15(21%)			6(9%)	9(13%)	15(21%)		
Never	16(23%)	36(51%)	52(74%)			27(39%)	25(36%)	52(74%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**2.59**	**p = 0.274**	**34(49%)**	**36(51%)**	**70(100%)**	**0.95**	**p = 0.621**
Had preeclampsia during pregnancy										
Yes	7(10%)	5(7%)	12(17%)			6(9%)	6(9%)	12(17%)		
No	18(26%)	40(57%)	58(83%)			28(40%)	30(43%)	58(83%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**3.23**	**p = 0.072**	**34(49%)**	**36(51%)**	**70(100%)**	**0.01**	**p = 0.913**
Had any infectious disease during pregnancy										
Yes	1(1%)	3(4%)	4(6%)			3(4%)	1(1%)	4(6%)		
No	24(34%)	42(60%)	66(94%)			31(44%)	35(50%)	66(94%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**0.21**	**p = 0.645**	**34(49%)**	**36(51%)**	**70(100%)**	**1.19**	**p = 0.276**
Make use of analgesics during pregnancy										
Always	2(3%)	1(1%)	3(4%)			1(1%)	2(3%)	3(4%)		
Sometimes	16(23%)	33(47%)	49(70%)			21(30%)	28(40%)	49(70%)		
Never	7(10%)	11(16%)	18(26%)			12(17%)	6(9%)	18(26%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**1.53**	**p = 0.465**	**34(49%)**	**36(51%)**	**70(100%)**	**3.28**	**p = 0.194**

Table 3b: Distribution of maternal risk factors in association with child's age bracket and gender (contd.)

	Child's age bracket					Gender				
Variables	**5-8years**	**9-17 years**	**Total**	X^2	**p-value**	**Male**	**Female**	**Total**	X^2	**p-value**
Make use of antibiotics during pregnancy										
Always	0(0%)	0(0%)	0(0%)			0(0%)	0(0%)	0(0%)		
Sometimes	9(13%)	4(6%)	13(19%)			5(7%)	8(11%)	13(19%)		
Never	16(23%)	41(59%)	57(81%)			29(41%)	28(40%)	57(81%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**7.81**	**p = 0.020**	**34(49%)**	**36(51%)**	**70(100%)**	**0.65**	**p = 0.721**
Make use of antihypertensive drugs during pregnancy										
Always	2(3%)	3(4%)	5(7%)			2(3%)	3(4%)	5(7%)		
Sometimes	5(7%)	2(3%)	7(10%)			5(7%)	2(3%)	7(10%)		
Never	18(26%)	40(57%)	58(83%)			27(39%)	31(44%)	58(83%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**4.48**	**p = 0.106**	**34(49%)**	**36(51%)**	**70(100%)**	**1.71**	**p = 0.426**
Make use of insulin during pregnancy										
Yes	6(9%)	5(7%)	11(16%)			7(10%)	4(6%)	11(16%)		
No	19(27%)	40(57%)	59(84%)			27(39%)	32(46%)	59(84%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**2.02**	**p = 0.156**	**34(49%)**	**36(51%)**	**70(100%)**	**1.19**	**p = 0.276**
Had gestational diabetes during pregnancy										
Yes	12(17%)	36(51%)	48(69%)			16(23%)	32(46%)	48(69%)		
No	13(19%)	9(13%)	22(31%)			18(26%)	4(6%)	22(31%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**7.64**	**p = 0.006**	**34(49%)**	**36(51%)**	**70(100%)**	**14.2**	**p < 0.001**
Child was delivered by										
Normal vaginal delivery	18(26%)	4(6%)	22(31%)			15(21%)	7(10%)	22(31%)		
C-Section	7(10%)	41(59%)	48(69%)			19(27%)	29(41%)	48(69%)		
Total	**25(36%)**	**45(64%)**	**70(100%)**	**29.7**	**p < 0.001**	**34(49%)**	**36(51%)**	**70(100%)**	**4.94**	**p = 0.026**

Table 3c: Distribution of maternal risk factors in association with age at diagnosis of the child/adolescent

	Age at diagnosis of the child/adolescent							
Variables	**< 2 years**	**2-5 years**	**6-8years**	**9-15 years**	**15-19years**	**Total**	**X^2**	**p-value**
Tea consumption during pregnancy								
Always	2(3%)	3(4%)	12(17%)	22(31%)	4(6%)	43(61%)		
Sometimes	3(4%)	6(9%)	4(6%)	9(13%)	0(0%)	22(31%)		
Never	0(0%)	1(1%)	1(1%)	2(3%)	1(1%)	5(7%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**10.35**	**p = 0.241**
Coffee consumption during pregnancy								
Always	1(1%)	1(1%)	0(0%)	0(0%)	1(1%)	3(4%)		
Sometimes	1(1%)	4(6%)	3(4%)	5(7%)	2(3%)	15(21%)		
Never	3(4%)	5(7%)	14(20%)	28(40%)	2(3%)	52(74%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**14.17**	**p = 0.077**
Had preeclampsia during pregnancy								
Yes	2(3%)	1(1%)	2(3%)	4(6%)	3(4%)	12(17%)		
No	3(4%)	9(13%)	15(21%)	29(41%)	2(3%)	58(83%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**9.6**	**p = 0.048**
Had any infectious disease during pregnancy								
Yes	1(1%)	0(0%)	1(1%)	2(3%)	0(0%)	4(6%)		
No	4(6%)	10(14%)	16(23%)	31(44%)	5(7%)	66(94%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**2.81**	**p = 0.590**
Make use of analgesics during pregnancy								
Always	1(1%)	0(0%)	1(1%)	0(0%)	1(1%)	3(4%)		
Sometimes	2(3%)	8(11%)	12(17%)	25(36%)	2(3%)	49(70%)		
Never	2(3%)	2(3%)	4(6%)	8(11%)	2(3%)	18(26%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**10.27**	**p = 0.247**

Table 3d: Distribution of maternal risk factors in association with age at diagnosis of the child/adolescent (contd.)

	Age at diagnosis of the child/adolescent							
Variables	**< 2 years**	**2-5 years**	**6-8years**	**9-15years**	**15-19 years**	**Total**	**X^2**	**p-value**
Make use of antibiotics during pregnancy								
Always	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)		
Sometimes	3(4%)	2(3%)	3(4%)	3(4%)	2(3%)	13(19%)		
Never	2(3%)	8(11%)	14(20%)	30(43%)	3(4%)	57(81%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**9.18**	**p = 0.328**
Make use of antihypertensive drugs during pregnancy								
Always	1(1%)	2(3%)	1(1%)	0(0%)	1(1%)	5(7%)		
Sometimes	2(3%)	1(1%)	1(1%)	2(3%)	1(1%)	7(10%)		
Never	2(3%)	7(10%)	15(21%)	31(44%)	3(4%)	58(83%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**15**	**p = 0.059**
Make use of insulin during pregnancy								
Yes	2(3%)	2(3%)	3(4%)	3(4%)	1(1%)	11(16%)		
No	3(4%)	8(11%)	14(20%)	30(43%)	4(6%)	59(84%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**3.58**	**p = 0.466**
Had gestational diabetes during pregnancy								
Yes	2(3%)	4(6%)	10(14%)	28(40%)	4(6%)	48(69%)		
No	3(4%)	6(9%)	7(10%)	5(7%)	1(1%)	22(31%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**10.79**	**p = 0.029**
Child was delivered by								
Normal vaginal delivery	1(1%)	2(3%)	6(9%)	13(19%)	0(0%)	22(31%)		
C-Section	4(6%)	8(11%)	11(16%)	20(29%)	5(7%)	48(69%)		
Total	**5(7%)**	**10(14%)**	**17(24%)**	**33(47%)**	**5(7%)**	**70(100%)**	**4.29**	**p = 0.368**

Distribution of nutritional risk factors in association with socio demographic characteristics of the participants

Table 4 summarized the results of association between nutritional risk factors and socio demographic variables. It was shown that child's mode of feeding as an infant as a nutritional risk factor displayed significant association with child's age bracket (p = 0.006), and age at diagnosis of the child/adolescent (p = 0.010). Most of the participants who had combination of exclusive breastfeeding and formula food were within 5-8 years age bracket 28(40%) and female 22(31%). Moreover, a larger number of them 30(43%) were diagnosed with type 1 diabetes at 10-14 years age bracket with significant association (X^2= 19.98; p = 0.010). Table 4 also showed that duration of breast feeding the child as nutritional risk factor only displayed significant association with age at diagnosis of the child/adolescent (p = 0.042). However, majority of the respondents that were breastfed for ≥1 year 27(45%) were those within the age bracket of 10-19 years and were female 31(44%). Moreover, a larger number of them 31(44%) were diagnosed with type 1 diabetes at 10-14 years age bracket with significant association (X^2= 9.89; p = 0.042).

Table 4: Distribution of nutritional risk factors in association with socio demographic characteristics of the participants

	Child's mode of feeding as an infant						Duration of breast feeding the child				
Variables	**Exclusively**	**Formula fed (cow's milk)**	**Both**	**Total**	X^2	**p-value**	**≤1 year**	**≥1 year**	**Total**	X^2	**p-value**
Child's age bracket											
5-8 yrs	7(10%)	8(11%)	10(14%)	25(36%)			4(7%)	21(35%)	25(42%)		
9-16 yes	15(21%)	2(3%)	28(40%)	45(64%)			8(13%)	27(45%)	35(58%)		
Total	**22(31%)**	**10(14%)**	**38(54%)**	**70(100%)**	**10.15**	**p = 0.006**	**12(20%)**	**48(80%)**	**60(100%)**	**0.04**	**p = 0.650**
Gender											
Male	14(20%)	4(6%)	16(23%)	34(49%)			7(10%)	27(39%)	34(49%)		
Female	8(11%)	6(9%)	22(31%)	36(51%)			5(7%)	31(44%)	36(51%)		
Total	**22(31%)**	**10(14%)**	**38(54%)**	**70(100%)**	**2.93**	**p = 0.231**	**12(17%)**	**58(83%)**	**70(100%)**	**0.55**	**p = 0.457**
Age at diagnosis of the child/adolescent											
< 2 yrs	2(3%)	1(1%)	2(3%)	5(7%)			3(4%)	2(3%)	5(7%)		
2-5 yrs	4(6%)	3(4%)	3(4%)	10(14%)			2(3%)	8(11%)	10(14%)		
6-9 yrs	3(4%)	3(4%)	11(16%)	17(24%)			4(6%)	13(19%)	17(24%)		
10-14 yrs	2(3%)	1(1%)	30(43%)	33(47%)			2(3%)	31(44%)	33(47%)		
15-19 yrs	1(1%)	2(3%)	2(3%)	5(7%)			1(1%)	4(6%)	5(7%)		
Total	**12(17%)**	**10(14%)**	**48(69%)**	**70(100%)**	**19.98**	**p = 0.010**	**12(17%)**	**58(83%)**	**70(100%)**	**9.89**	**p = 0.042**

Discussion

This study aimed to determine the level of association between socio-demographic variables and risk factors of T1DM among children and adolescents in facilities in Owerri municipal and west LGA, Imo state. The respondents were insignificantly dominated by female (51%) Christians (91%) from Igbo tribe (83%) and were within the age bracket of 9-17 years (64%). Most of them were in secondary school (61%) and their caregivers achieved Tertiary education as their highest level of education (64%). In addition, majority of them were diagnosed of type 1 diabetes at the age bracket of 10-15 years (47%). In similar study conducted in Aswan University Hospital, Ismail *et al*. (2020) reported lower population of adolescents (26%) and female respondents (44%). In the present study also, greater proportion (80%) of the respondents belonged to the normal weight category of body mass index (BMI) with significant association. A BMI value that is less than 18.5 is considered underweight; 18.5 and 24.9 is considered normal; 25.0 and 29.9 is considered overweight; a BMI value that is 30 and above is considered obese. According to [18], as the body mass index (BMI) of adolescents increase, the likelihood of developing metabolic syndrome also increases.

As regards family history risk factors among the participants, greater proportions of them had siblings (57%) and grandparents (70%) that suffered Type 1 diabetes (57%) and Type 2 Diabetes (90%) respectively. This value was higher compared to 19.4% recorded for family history of Type 2 diabetes [19]. A family history of diabetes is one of the primary risk factors for diabetes [20]. Previous studies have shown that mothers with a family history of diabetes pose a higher risk of diabetes development in their children than fathers [21], and children of mothers with a family history of diabetes have a higher risk of poor glycemic control [22].

Moreover, greater proportions of the mothers in the present study significantly had gestational diabetes (69%) but did not have preeclampsia (83%) and infectious disease (94%) during pregnancy. Besides, during pregnancy, most of them never make use of antibiotics 57 (81%), antihypertensive (83%) and insulin (84%) drugs but sometimes (70%) make use of analgesics during pregnancy. Consequently, significantly larger proportions of the participants were delivered by C-Section (69%). On nutritional risk factors of type 1 diabetes mellitus in the current study, a good number of the participants (54%) received both exclusive and formula feed with the breast feeding lasting for more than one year (80%).

Conclusion

In conclusion, they had high rates of maternal risk factors (high tea consumption during pregnancy, frequent use of analgesics during pregnancy, delivery through C-Section, and gestational diabetes). Finally, nutritional risk factors associated were the introduction of formula (cow's milk) during infancy (before one year of age). Breast feeding lasted for more than one year. In addition, socio demographic attributes demonstrated significant association with some risk factors of type 1 diabetes. Majority of the participants within 10-19 years were born at full term. Most of them with normal weight were female participants whose mothers experienced gestational diabetes during pregnancy ($p < 0.001$) and delivered with C-Section ($p = 0.026$). Higher proportions of the participants with family history of Type 2 Diabetes, constant tea consumption, use of analgesics, antihypertensive, insulin as well as gestational diabetes of mother during pregnancy and child being delivered by C-Section were mostly in secondary school.

Authors' contributions

Idea was conceived by Okoro, Supervised by Nwaokoro and Dozie, Manuscript by Dozie.

Author details

Department of Public Health, Okoro Chisomuaga Chidinma, J.C Nwaokoro, U.M. Dozie, Odinaka Kizito C.

Competing interest

The authors declare that they have no competing interests**.**

Funding

No funding.

Recommendations

Based on the findings of this research work the following recommendations were made

1. Regular physical activity ≥3 times per week for ≥60 minutes each time should be encouraged for all children and adolescents with diabetes.
2. There is necessity to develop an intervention program for the early prevention of diabetes centered on children

and adolescent diabetes high-risk groups. Equally, interventions that aim to minimize exposure to those risk factors are recommended in genetically susceptible patients.

3. Future research should be aimed at examining wider samples and to design health promotion interventions for Type 1 diabetes mellitus (T1DM) adolescents**.**
4. Future research needs to focus on whether culture, language and other socio-demographic attributes has an impact on the correlation between T1DM and its management measures among children and adolescents as this has the potential to widen our knowledge on such psychosocial factors and their role for patients' coping and treatment results. Furthermore, studies using instruments that target more specific psychosocial factors like eating disorders, fear of hypoglycemia, problem areas in diabetes and family related factors in association to children and adolescents with T1DM is recommended.
5. A nutritional food menu should be put in place to help manage blood sugar levels of children and adolescents living diabetes and avoid some of its complication.

References

1. Atkinson M, Eisenbarth G, Michels A. Type 1 diabetes. The Lancet. 2014; 383(9911):69-82.
2. Borus JS, Laffel L. Adherence challenges in the management of type 1 diabetes in adolescents: Prevention and intervention. Current Opinion in Pediatrics. 2010; 22(4):405-411.
3. Butalia S, Kaplan G, Khokhar B, Rabi D. Environmental risk factors and type 1 diabetes: Past, present, and future. Canadian Journal of Diabetes. 2016; 40(6):586-593.
4. Butler DA, Zuehlke JB, Tovar A, Volkening LK, Anderson BJ, Laffel LMB. The impact of modifiable family factors on glycaemic control among youth with type 1 diabetes. Pediatric Diabetes. 2008; 9(4 Part2):378-381.
5. Daneman D. Type 1 diabetes. The Lancet. 2006; 367(9513):847-858.
6. DeFronzo R, Ferrannini E, Zimmet P, Alberti G. International Textbook of Diabetes Mellitus (2 vols.) (4th edition). Chichester: John Wiley and Sons, 2015.
7. Egro F. Why is type 1 diabetes increasing? Journal of Molecular Endocrinology. 2013; 51(1):1-13.
8. Feltbower RG, Bodansky HJ, Patterson CC, Parslow RC, Stephenson CR, Reynolds C, *et al*. Acute complications and drug misuse are important causes of death for children and young adults with type 1 diabetes: Results from the Yorkshire Register of diabetes in children and young adults. Diabetes Care. 2008; 31(5):922-926.
9. Ghannem H, Harrabi I, Gaha R, Trabelsi L, Chouchene I, Essoussi, AS, *et al*. Epidemiology of diabetes in a school children population in Tunisia. Diabetes and Metabolism Journal. 2001; 27(5 Part1):613-617.
10. Halvorson M, Yasuda P, Carpenter S, Kaiserman K. Unique challenges for pediatric patients with diabetes. Diabetes Spectrum. 2005; 18(3):167-173.
11. International Diabetes Federation. IDF diabetes atlas(10th ed.), 2022. https://diabetesatlas.org/
12. Kim H, Elmi A, Henderson CL, Cogen FR, Kaplowitz PB. Characteristics of children with type 1 diabetes and persistent suboptimal glycemic control. Journal of Clinical Research in Pediatric Endocrinology. 2012; 4(2):82-88.
13. Majaliwa ES, Munubhi E, Ramaiya K, Mpembeni R, Sanyiwa A, Mohn A. Survey on acute and chronic complications in children and adolescents with type 1 diabetes at Muhimbili National Hospital in Dar es Salaam, Tanzania. Diabetes Care. 2007; 30(9):2187-2192.
14. Mobasseri M, Masoud S, Tarlan A, Nafiseh V, Hossein HF, Morteza G. Prevalence and incidence of type 1 diabetes in the world: A systematic review and meta-analysis. Health Promotion Perspectives. 2020; 10(2):98-115.
15. Nwanedo OU. The prevalence and level of awareness of diabetes mellitus in children aged 10 to 16 years in Lagos State. [A dissertation submitted in part fulfillment of the requirements for the award of the fellowship of the National Postgraduate Medical College of Nigeria in the Faculty of Paediatrics], 2014.
16. Silverstein J, Klingensmith G, Copeland K, Plotnick L, Kaufman F, Laffel L, *et al*. Care of children and adolescents with type 1 diabetes: A statement of the American Diabetes Association. Diabetes Care. 2005; 28(1):186-212.
17. Van Belle T, Coppieters K, Von Herrath M. Type 1 diabetes: Etiology, immunology, and therapeutic strategies. Physiological Reviews. 2011; 91(1):79-118.
18. Bang SY. Prevalence and related factors of metabolic syndrome in Korean adolescent. Jounal of the Korea Academia- Industrial Cooperation Society. 2018; 19:309-316.
19. Sadiq CH, Azize PM. Confounding Risk Factors in Developing Type 1 Diabetes Mellitus among Children and Adolescents at Sulaimani Chronic Diabetes Health Center, 2021.
20. American Diabetes Association. Insulin Basics, May 2020. https://www.diabetes.org/diabetes/medication-management/insulin-other-injectables/insulin-basics
21. InterAct Consortium, Scott RA, Langenberg C, Sharp SJ, Franks PW, Rolandsson O, Drogan D, *et al*. The link between family history and risk of type 2 diabetes is not explained by anthropometric, lifestyle or genetic risk factors: the EPIC-InterAct study. Diabetologia. 2013; 56(1):60-69.
22. Wu M, Wen J, Qin Y, Zhao H, Pan X, Su J. Familial History of Diabetes is Associated with Poor Glycaemic Control in Type 2 Diabetics: A Cross-sectional Study. Scientific Reports. 2017; 7(1):1432.